

Problem Set 9. Spectrophotometric Methods of Analysis
Chem 2222 Summer 2008

- A solution containing 7.20 ppm KMnO_4 has a transmittance of 0.584 in a 1.00-cm cell at a wavelength near 525 nm.
 - Convert the transmittance reading to absorbance.
 - Calculate the molar absorptivity of KMnO_4 based on these data (mol wt $\text{KMnO}_4 = 158.0$ g/mol).
- A 2.980-g petroleum sample was decomposed by wet ashing and subsequently diluted to 250 mL in a volumetric flask. Cobalt was determined by adding the following reagents to 25.00-mL aliquots of this diluted solution as follows:

Aliquot	Reagent Volume, mL			Absorbance in 1.00-cm cell
	Co(II), 5.00 ppm	Ligand	Water	
1	0.00	20.00	5.00	0.550
2	5.00	20.00	0.00	0.610

Assume that the Co(II)/ligand chelate obeys Beer's law, and calculate the percentage of cobalt in the original sample.

- A 25.00-mL sample of well water containing dissolved iron was treated with hydroxylamine hydrochloride, pH 5 buffer, and 1,10-phenanthroline, and diluted to 100.0 mL. Absorbances were measured at 510 nm using a 1.00-cm cell.
 - The prepared sample had an absorbance of 0.540 (all absorbances measured relative to water as reference).
 - A standard solution prepared in the same fashion, containing 5.00 mL of 5.00×10^{-4} M $\text{Fe}(\text{ClO}_4)_3$ and the reagents (no sample) had an absorbance of 0.284.
 - The reagent blank had an absorbance of 0.006.
 - Calculate the molar absorptivity of the iron complex.
 - Calculate the molar concentration of iron in the original well water sample.
- The acid-dissociation constant for an acid-base indicator HIn is 8.50×10^{-5} . At 600 nm, the molar absorptivities are 2230 for HIn and 8900 for In^- . Calculate the absorbance at 600 nm of a 1.00×10^{-4} M solution of the indicator at pH 4.80 in a 1.00-cm cell.
- The figure on the left below shows the photometric titration curve at 745 nm for titration of 40.0 mL of a solution of Bi^{3+} and Cu^{2+} with 0.01200 M EDTA. The copper-EDTA complex absorbs at this wavelength; none of the other species absorbs. Calculate the concentrations of Bi^{3+} and Cu^{2+} in the solution.
- A multiple standard addition method was used for determining Fe^{3+} in a natural water sample. Into each of five 50-mL volumetric flasks was added
 - 5.00 mL of the sample,
 - 0.00, 5.00, 10.00, 15.00, 20.00-mL aliquots of 6.20 ppm Fe^{3+} ,
 - excess SCN^- and water to dilute to volume.

The absorbance due to the FeSCN^{2+} formed was measured at 480 nm and are plotted in the figure (below right). Extension of the linear fit to the abscissa yields an intercept of -7.45 mL. Calculate the concentration of iron in the water sample.

